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RECONSTRUCTION OF THE CHALCIDID GENUS *HYPOPTEROMALUS* ASHMEAD OF THE FAMILY *PTEROMALIDÆ*.

Its Position, Redescription, History and the Synonymy of Its Type Species.

By A. Arsene Girault.

Introductory.

Quite incidentally, while examining a quantity of pteromalines reared from the cocoons of *Apanteles congregatus* (Say) taken from nearly fullgrown larvæ of *Phlegethontius sexta* (Johannsen) and having decided by comparison that they were the so-called common hyperparasitic *Hypopteromalus tabacum* (Fitch), I proceeded to verify the determination by a careful examination of their structures.

The results of this examination showed a different structure of the mandibles than one would expect from the present tribal position of the genus, or from the description of what was designated as its type species—*Pteromalus tabacum* Fitch. Other examinations made of the mandibles of two series of specimens determined by the late Doctor Ashmead himself agreed with the structure found in the first, so that there can be no doubt but that all three series of specimens are one and the same species. Other series of specimens were then compared with the first three series, being found identical in every case.

On account of the fact that the genus itself is but poorly described and its type species, due to the times, almost unrecognizably so, I have attempted the following reconstruction based on a large series of specimens, as recorded beyond. At first, however, on account of the characteristic dentation of the mandibles, it should be stated that the removal of the genus from the Ashmeadian *Pteromalini* to the *Rhaphitelini* becomes necessary, and that its type species, as I find by comparison, and which was first pointed out by Riley (1881), is symonymic with what has heretofore been known as *Gastrancistrus viridescens* (Walsh). The history of the genus will be considered later.

FAMILY PTEROMALIDAE—SUBFAMILY PTEROMALINÆ

Tribe *Rhaphitelini*

Genus **Hypopteromalus** Ashmead.

(Type: **Glyphe viridescens** Walsh.)

Ashmead, 1904, pp. 310, 378.

Schmiedeknecht, 1909, p. 355.

Normal position; description based on the type species.

♀.—Normal in stature. Metallic green, head and thorax punctate. Abdomen with short petiole.

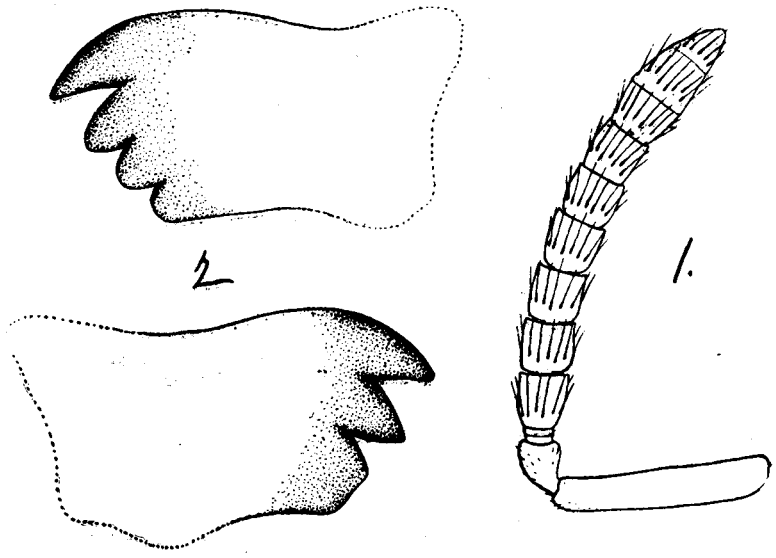
(Cephalic aspect) Head conspicuous, almost circular, its margins rounded, the face broad, sublenticular, the clypeus wider than long, its surface slightly inpressed below the general surface of the face so that the sclerite is distinctly outlined longitudinally, radially rugulose or striate, its sutures obsolete, its apical margin practically truncate, very slightly concave, along its whole length very slightly emarginate at the meson and a slight incision is present along the ventral border of the face just laterad of the clypeus, involving the sclerite's lateral margin; basal (dorsal) margin of the clypeus slightly convex at the meson, bisinuate, its dorso-lateral angle slightly more impressed. Antennæ inserted slightly below (ventrad) of the middle of the "face" or the distance between the cephalic margin of the vortex and the apical margin of the clypeus, slightly over a third of the way up (dorsad) the margins, distinctly above (dorsad) an imaginary line drawn between the ventral ends of the eyes and farther from the clypeus than that sclerite is long at the meson, the bulbs distinctly separated. Face ventrad, directly below the antennal insertions, with two shallow longitudinal impressions, one on each side of the meson, entering the dorso-lateral angles of the clypeus[1]; mesal facial impressions moderately narrow but distinct, extending nearly to the cephalic ocellus from the antennal bulbs, its margins not acute and the antennal scrobes obsolete or not differentiated from the mesal facial impression.

(Lateral aspect) Genal sulcus inconspicuous, short, not half as long as the eye, the latter ovate; genæ rounded; general shape of head, ovate.

(Cephalic aspect) Head distinctly wider than the greatest width of the thorax, nearly thrice wider than long, the vertex broad, obtuse,

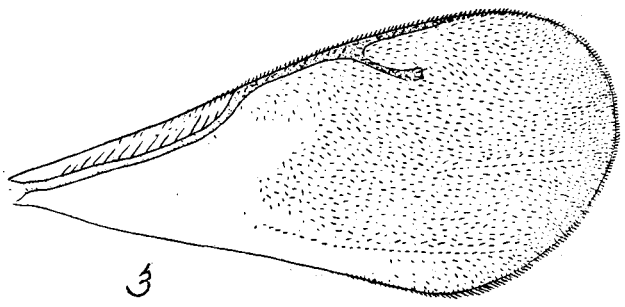
1) Also an obscure oblique impression, narrow, running from about the bulb of the antenna ventro-lateral to the margin of the head, between the dorso-lateral angle of the clypeus and the ventral end of the eye, nearer the former; this is visible in certain lights only.

narrowed slightly at the meson, but its occipital margin distinctly concave; ocelli in a triangle in the center of the vertex, nearer to the cephalic margin of the latter than to its occipital margin and the group distance from the eyes. The occipital foraminal depression marked, concave, its margins rounded or obtuse, immargined. Antennæ 13-jointed, with two distinct ring-joints and a 3-jointed club, the flagellum usually moderately clavate (lateral aspect), the club conical and wider than the funicle but not abrupt or spherical and the funicle cylindrical, very gradually enlarging distad; pedicel obconic, smaller than the first funicle joint or subequal to it, the six funicle joints all subequal and subquadrate. (Fig. 1).



Pronotum visible, widened or dilated laterad, narrow at the meson, at that point but a sixth the length of the mesoscutum, subobtuse; parapsidal furrows not conspicuous but distinct, shallow, incomplete, extending caudo-mesad from the cephalic margin of the scutum to about two-thirds their length; cephalic and caudal margins of the mesoscutum gently convexed; axillæ widely separated; scutellum nearly as in *Habrocytus thyridopterygis* Ashmead, normal, with a rather obscure transverse groove just before (cephalad) of its apex, best seen from the caudo-lateral aspect in shadow and appearing

from dorsal and caudal aspects as a brighter colored, brassy, apparently slightly raised line; scutellum along the meson subequal to the length of the mesoscutum. Mesopostscutellum narrow, usual for the subfamily, margined. Metathorax punctate, declivous, slightly shorter than the scutellum, the median carina inconspicuous, complete or extending nearly to the neck, the lateral carina or fold represented on each side by a distinct, slightly curved, complete sulcus with margined, carinated or sharp margins, its lateral margin more distinct, being properly the lateral carina; these lateral sulci are nearly longitudinally straight for half their length or slightly convex, then curve slightly caudo-mesad and then nearly caudad again; spiracular sulcus following laterad, extending from the caudo-lateral end of the spiracle and distinctly shorter than the lateral sulcus and nearly straight; the metathoracic spiracle large, subreniform, oblique in position, its mesocephalic end near to the mesopostscutellum yet not touching the narrow transverse metapræscutum or metascutum; neck not as distinct as in *Pteromalus* Swederus, hood-shaped and from the lateral aspect distinct but not rising very much above the general surface, overlapping the petiole of the abdomen.



Abdomen with a distinct petiole which is short and often hidden by the upper inclination of the region and subequal in length to the pedicel of the antennæ, or nearly so; from lateral aspect, abdomen variable, usually subtriangular, the apex of the triangle ventrad at segment 5, varying to conical or cuneate, pointed caudad, convex ventrad and flat to the concave dorsad, the tip of the ovipositor often exserted; adbomen subequal to the thorax in length; from dorsal aspect, conic-ovate or fusiform, widest at the third or fourth segment (third body segment); segment two longest, twice longer than segment three, its caudal margin slightly convex and entire; segment three nearly twice longer than segment five; four, five and six sub-

equal in length, gradually decreasing, their caudal margins straight; segment six sometimes slightly longer than segment three; segment eight conical, subequal in length to segment seven. Ventrad and dorsad, caudal margins of the segments with a slight whitish pubescence or fringe.

Fore wings normal, with the usual dense discal ciliation, the submarginal vein slenderer than the marginal and about a third longer, widening at its curve; the marginal vein normal, thrice thicker than the submarginal vein at its middle and distinctly wider than either the postmarginal or stigmal veins and a fourth longer than the former and a third longer than the latter; postmarginal vein distinctly longer than the stigmal vein which is slightly curved, bearing a moderately large club with a cuneate uncus from its cephalo-distal margin; marginal cilia short. Hind wings ciliate distally. Fore wings broadest at points opposite the knob of the stigmal vein. (Fig. 3).

Legs normal, slender, the tibial spurs all single, moderately stout, the cephalic femora stout but not abnormally or conspicuously so, the tarsi all 5-jointed, the proximal joint of the caudal tarsi over twice the length of the caudal tibial spur and about twice the length of the second tarsal joint, the fourth joint, as usual, smallest.

Left mandible 3-dentate, the inner (mesal) tooth broadest, nearly truncate, the second tooth intermediate in size and shape, acutely dome-shaped and the third, outer (lateral) tooth longest, slenderest, acute, subfalciform. (Fig. 2). Right mandible 4-dentate, the teeth gradually lengthening laterad, the mesal one shortest, obtusely convex, the second longer, obtusely conic, the third still longer, subacutely conical, the fourth or lateral tooth longest, acute, subfalciform. (Fig. 2). Maxillary palpi 4-jointed, the apical joint longest, twice the size of joint three, clavate, the proximal joint shortest. Labial palpi 3-jointed, the middle minute, the others subequal.

♂. The same. The adbomen flat, depressed, from dorsal aspect elliptical-oval, with a large yellowish white area in the dorsal and ventral basal region. Petiole shorter than in the female, not as noticeable, the segmentation of the adbomen not as distinct. Antennæ inserted slightly higher up on the face, slenderer. Mandibular and other characters the same as in the female. Similar to male *Pteromalus* Swederus or nearly so.

A genus of moderately stout, metallic green hyperparasites with the general aspect of *Pteromalus* and about the same stature.

On account of the insertion of the antennæ, high up on the head, near the middle of the face and not especially near the

mouth border, the mandibular characters, the presence of spiracular sulci and general habitus, as well as on account of its habits, the correct position of this genus, is, I think, in the pteromaline tribe *Rhaphitelini,* though its short abdominal petiole would seem to ally it with the *Sphegigasterinæ Sphegigasterini.* The genus appears to be similar to *Pteromalus* Swederus in many respects, especially in the general habitus of the males. In its new position it is closely allied to the genus *Habrocytus* Thomson, falling in that Thomsonion-Ashmeadian division of the *Rhaphitelini* having normal cephalic femora, mediumsized stigmal knobs and relatively short antennal pedicels. The genus is separated from *Habrocytus* by means of the less produced, shorter, usually triangular (lateral aspect) abdomen, the presence of the short petiole, the differences in the length of the abdominal tergites and other less noticeable characters to be summed up in general term *habitus.*

History of the Genus.

This genus is a recent description. In a table of the genera of his tribe *Pteromalini* of the subfamily *Pteromalinæ,* the late Dr. William Harris Ashmead, in his monumental work "Classification of the Chalcid Flies" (Ashmead, 1904, p. 320), established the genus *Hypopteromalus* with the species *Pteromalus tabacum* Fitch as type. As extracted from the table of genera mentioned the following diagnostic characters belong to the genus:

Occipital foraminal depression emargined; metathorax produced into a subglobose neck, which is not very distinct; postmarginal vein always longer than the stigmal vein, but not very distinctly so, pedicel subequal to the first funicle joint, shorter, the antennæ with two ring joints; metathoracic spiracles large, elliptical; abdomen ovate to conic-ovate, not longer than the combined lengths of the head and thorax, the caudal margins of the segments straight, not incised or emarginate at the meson, the second segment about three times longer than the third, segments four and five united not longer than the third, those beyond variable, subequal in length; venter usually strongly compressed or keeled. Metanotum with a distinct median carina, the lateral folds incomplete, indicated towards the base.

In the table the genus was placed next to *Pteromalus* Swederus, but failing to interpret its characters properly, as an alternative, with *Diglochis* Foerster. During the short time of its existence, it has not been the subject of subsequent systematic treatment,

though Schmiedeknecht (1909) briefly gives its characters, and, as it stands today, contains but a single species[2], the one upon which it was founded—(*Gastrancistrus*) *Hypopteromalus* (*tabacum*) *viridescens* (Walsh). It was first mentioned in the literature by Garman (1897), seven years before its description, and again by Ashmead (1900), four years prior to that time. As pointed out later, this genus has nothing to do with the *Miscogasterida.* Crawford (1910) refers to two of its characteristics and gives a table of the species.

Host Relations of the Genus.

Hypopteromalus viridescens (Walsh), representing the genus, is a common hyperparasite of the higher *Lepidoptera,* such as *Sphingidæ* and *Noctuidæ,* attacking primarily the microgaster genus *Apanteles* Foerster, issuing as adults from their cocoons. It is known to attack *Apanteles congregatus* (Say) when a primary parasite of *Phlegethontius, Ceratomia* and *Heliophila; (Apanteles) Microplitis catalpæ* (Riley) on *Ceratomia; Apanteles militaris* (Walsh) and *A. linguitidis* (Riley) on *Heliophila;* and Fitch (1865) records it as a secondary parasite of *Sphinx kalmiæ* Smith and Abbot, the host being a microgasterid; and Dimmock (1898) as being secondary on *Smerinthus geminatus* and *Ampelophaga myron.* I have reared it from what appear to be the cocoons of *A. smerinthi* Riley on a willow leaf. I also record beyond, rearing it from *Sphecodina abbotii,* upon which it is secondary, and from the cocoons of *Apanteles congregatus* (Say) on the larvæ of *Ceratomia catalapæ* Boisduval.

Hypopteromalus apantelophagus Crawford is parasitic on *Glyptapanteles japonicus* and *H pœcilopus* Crawford on *Glyptapanteles sp.*

Distribution of the Genus.

The species *viridescens* is widely distributed in the United States, of which it is most probably a native. In the literature, it is recorded from the following localities: Illinois (Schuyler

2) Since this was written Crawford (1910) has described two species from Japan and Europe, *H. apantelophagus* and *H. pœcilopus,* respectively; these are not included here, but both differ from the type species in having an elongate first funicle joint. Crawford here and previously (Idem, 1909) calls attention to its abdominal petiole and anomalous tribal position.

County, Algonquin); New York (Saratoga Springs, Long Island); Louisiana (?Baton Rouge); New Hampshire; New Jersey; Kentucky; Ohio (Jackson).

I add the following new localities: Illinois (Urbana, and Champaign, Quincy, Parker, Normal and Polo); Maryland (Baltimore-Sparrows' Point). The genus at present is known to occur over the area bounded by Maryland on the east, New Hampshire on the north, Louisiana on the south and Illinois on the west. Crawford's two new species are from Japan and Europe.

The Type Species of the Genus.

Hypopteromalus viridescens (Walsh).

Glyphe viridascens Walsh, 1861, pp. 364, 370, fig. 11.—Idem, 1865, p. 483, fig. 11.
Pteromalus tabacum Fitch, 1865, pp. 224-225, 227.
Glyphe viridescens Walsh (= *tabacum* Fitch), Riley, 1881, p. 302.
Glyphe viridescens.—Thomas, 1881, p. 39.
Tridymus viridascens (Walsh), Riley, 1883, p. 127.
Glyphe viridescens Walsh, Howard, 1865, p. 44.—Cresson, 1887, p. 242.
Pteromalus tabacum Fitch, Id., Ib., p. 45.—Cresson, 1887, p. 243.
Glyphe viridascens Walsh, Riley and Howard, 1898, p. 138.
Gastrancistrus viridescens (Walsh), de Dalla Torre, 1898, p. 205.
Pteromalus tabacum Fitch, Dimmock, 1898, p. 149.
Hypopteromalus tabacum Fitch, Ashmead, 1900, p. 559.
Hypopteromalus tabacum Fitch, Id., 1904, pp. 320, 378.
Hypopteromalus tabacum Fitch, Nason, 1906, p. 152.
Hypopteromalus tabacum Fitch, Schmiedeknecht, 1909, p. 355
Hypopteromalus tabacum Fitch, Crawford, 1910, p. 21.

Redescription of (Glyphe) Hypopteromalus viridescens (Walsh).

Normal position.

♀.—Length variable, 1.75—2.55mm.; 2.25 mm. average.

Color variable in depth of tones; usual general color deep metallic Prussian green, with brassy reflections, the metanotum with some bluish, abdomen darker greenish, the large second segment metallic purplish and the other proximal segments reflecting purplish in certain lights. Mandibles fulvous, fuscous at tips, palpi pure white, scape, tegulæ and the legs, excepting the lateral aspect of all coxæ, especially the caudal coxæ exteriorly which are metallic greenish,

fulvous, the flagellum darker, dusky brownish yellow, subfuscous. Scape often pallid yellowish; femora slightly darker than the tibiæ and tarsi which are often pallid; apical tarsal joints dusky; venation dusky yellowish. Wings hyaline; ocelli pinkish; eyes garnet. Ventum concolorous with the dorsal aspect of the body. Cephalic and intermediate coxæ much less metallic than caudal coxæ.

The whole of the head and thorax dorsad uniformly, moderately, polygonally punctate, the metanotum more coarsely so, subrugose, the thoracic pleura and venter smoother as are also the occipital foraminal depression and the caudal coxæ exteriorly (lateral aspect), the latter delicately reticulated; other coxæ practically smooth. Sparse whitish pubescence on the face, genæ and dorsum of pro and mesothorax, the coxæ, and a small tuft of longer white hairs on the dorso-lateral aspect of the metathorax. Abdomen smooth, with little or no sculpture. Eyes naked; cephalic ocellus and lateral ocelli suboval, equal, the lateral ocelli distinctly farther from each other than either is from the cephalic ocellus and each is still much farther from the respective eye margins than they are from each other, the distance being at least twice that separating other ocellus from the cephalic one.

Apex of hind wings obtuse.

Antennæ moderately hispid-pubescent, the scape practically naked, the pedicel and ring-joint with a few sparse hairs, the hairs on the funicle and club not arranged in well-defined rows. Scape cylindrical, nearly uniform in width, not quite as long as the pedicel, ring-joints and first three funicle joints united; pedicel obconic, narrowed slightly before the apex of the proximal half, not much shorter, but distinctly narrower than the first funicle joint and about three times the length of the united ring-joints; ring-joints small, subequal, the apical one larger, both narrower than the pedicel and the funicle; funicle joints all subequal and subquadrate, gradually shortening distad, joints one to four almost equal, slightly longer than wide, joint one slightly the longest; joints five and six almost equal, slightly shorter than the preceding but still somewhat longer than wide; club widest at the apex of its proximal joint, not quite as long as the united lengths of funicle joints four to six, the proximal club joint the widest antennal joint, widening distad and as long as the preceding joint (funicle joint six); intermediate club joint as wide at its base as the apex of the proximal joint, just the latter's opposite in shape, narrowing instead of widening, distad and equal to the proximal club joint in length or slightly longer; the distal joint somewhat shorter, conical. Under high power (objective ⅛ inch), the hairs of the funicle and club are seen to be unequal in size, some

of them wide and somewhat flattened, appearing in balsam mounts as longitudinal, pale furrows or grooves along the joints. (Fig. 1).

From 327 + specimens, ⅔ inch objective, 1 inch optic, Bausch and Lomb.

♂.—Length variable, 1.60—2.47 mm.; 2.08 mm. average.

The same as the female. Besides the sexual differences pointed in the generic description, the following specific details are different from those in the female: The body is a shade lighter in color and more brassy and the antennæ are slightly more pubescent and the joints different as follows: the legs are pallid yellowish, and the caudal coxæ laterally vary to pallid yellow, the other coxæ lighter.

Antennæ the same, the hairs sparser and softer, the funicle joints longer, distinctly longer than wide, and the scape broader, somewhat compressed, the club somewhat more slender, conic-ovate; pedicel distinctly shorter than the first funicle joints, funicle joints one to three subequal, and joints four to six subequal, the proximal group of three broader.

From 136 + specimens, ⅔ inch objective, 1 inch optic, Bausch and Lomb.

The coloration in this species is fairly constant; it may vary, however, to deep metallic French blue; it is more variable in the male, the large abdominal area sometimes more extensive, especially ventrad, and the caudal coxæ are sometimes without metallic coloration. Specimens which have been in collections for some years have a decided bluish color on the head and thorax. The metallic coloration on the intermediate and cephalic coxæ of the female may vary somewhat, too. The shape and size of the joints of the antennal funicle may vary considerably, comparatively speaking. Thus the last joint may be decidedly more transverse than usual, distinctly wider than long, while sometimes all of the joints are longer than wide and subequal; at other times, all are subquadrate, gradually shortening distad, the first and last joints not contrasting. Again, all may be wider than long when the first joint is slightly shorter (but larger) than the pedicel. These variations may all occur in the same series of reared specimens. No variation in the number of antennal segments have been met with.

Redescribed from the following of 472 specimens:

1. *Glyphe viridescens* Walsh; 1 ♂, 5 ♀ specimens reared from white cocoons, Urbana, Ill., June 21, 1887, and determined by Howard and Ashmead (Riley, in litt., June 13, 1891); accession No. 12806, Illinois State Laboratory of Natural History; (1 ♂, 5 ♀, tag

mounted; two slides, xylol-balsam, ♀ mandibles and antenna and ♀ wings—antenna).

2. *Hypopteromalus tabacum* (Fitch); 1 ♂, 5 ♀, reared at Baltimore, (Sparrows' Point), Md., February 2, 1904, from a small, compact circular mass of erect *Apanteles* cocoons on a willow leaf, covered and hidden by a fluffy mass of fine white silk like the silk of some spiders and probably those of *Apanteles smerinthi* Riley. Determined by Ashmead. Accession No. 41051, Illinois State Laboratory of Natural History. (5 ♂ tag-mounted; 2 slides, xylol-balsam, ♀ head, mandibles, antennæ and ♀ wings, leg and antenna).

3. *Hypopteromalus tabacum* (Fitch): 2 ♀ captured at large, July 10, September 27, 1895; in the Nason collection (Nason, 1906, p. 2), tagmounted, plus one slide bearing two antennæ and a pair of wings). Determined by Ashmead.

4. 110 ♂, 218 ♀ plus 5, reared during September 1908 from the cocoons of *Apanteles congregatus* (Say) parasitic on the larvæ of *Phlegethontius sexta* (Johanssen), Urbana, Ill. Accession No. 41052, Illinois State Laboratory of Natural History. (7 ♀, 6 ♀ tagmounted; xylol-balsam, ♀ legs, antenna and mandible—1 slide, ♂ ♀ antennæ, 1 slide; ♂ ♀ fore wings—1 slide. Accession No. 39857, (1 ♂, 11 ♀, tagmounted; 1 slide, ♀ antennæ and mandibles). No. 39931, (1 ♂, 1 ♀, tagmounted; 1 slide, ♀ head).

5. *Hypopteromalus viridescens* (Walsh): 1 ♂, reared in connection with supposed larvæ of *Ancylys comptana* Frölich, Urbana, Illinois (J. J. Davis), July 1, 1906. Accession No. 37248, Illinois State Laboratory of Natural History; (1 ♂, tagmounted; ♂ mandibles, xylol-balsam, 1 slide).

6. "*Sphegigaster cœruliventris* Ashmead"[3], Riley, in litt., June 13, 1891: 1 ♀, reared from microgasterid cocoon similar to those of *Apanteles congregatus*, Quincy, Illinois, October 1886. Accession No. 10957, Illinois State Laboratory of Natural History. (1 ♀, tagmounted, cocoon of host).

7. 7 ♂, 1 ♀ of *viridescens*, reared at Urbana, Ill., April 24, 1891, from *Apanteles* cocoon taken from larvæ of *Phlegethontius* on tomato, September 20, 1890 (F. M. Webster). Accession No. 16157, Illinois State Laboratory of Natural History. (7 ♂, 1 ♀ tagmounted, cocoons of host; xylol-balsam, ♂ mandibles, antenna).

8. 4 ♀ of *viridescens*, reared July 2, 1908, in the insectary of the state entomologist of Illinois, from the cocoons of *Apanteles congregatus* (Say) on the larvæ of *Ceratomia catalpæ* Boisduval, collected at Parker, Ill. (L. M. Smith), June 30, 1908. Accession No. 39324,

3) I have been unable to find trace in the literature of this species; it is apparently a *nomen nudum*.

Illinois State Laboratory of Natural History. (4 ♀, tagmounted; plus 1 slide bearing ♀ wings, antennæ and mandibles).

9. 2 ♂ of "*Pteromalus n. sp.*", Riley, in litt., June 13, 1891; and 3 ♂, 1 ♀ of *viridescens*, labeled as secondary parasites of *Phlegethontius quinquemaculata* Haworth (reared by S. A. Forbes), Normal Ill., Sept. 9, 1878, from *Apanteles* cocoons. Accession No. 16070, Illinois State Laboratory of Natural History. (4 ♂, 1 ♀ tagmounted, 2 host cocoons; plus 1 slide, ♂ ♀ antennæ, ♂ mandibles and wings.

10. 1 ♂, 6 ♀ of *viridescens*, reared April 25, 1891, from *Apanteles* cocoons taken from larvæ of *Phlegethontius* on tomato, Urbana, Ill., Sept. 20, 1890 (F. M. Webster). Accession No. 16177, same collection. (1 ♂, 6 ♀ tagmounted, 1 host cocoon; plus 1 slide bearing 1 ♂, 5 ♀ antennæ).

11. 23 ♀ of *viridescens* reared at Urbana, Ill., April 27, 1891, from *Apanteles* cocoons taken from larvæ of *Phlegethontius* on tomato, Sept. 20, 1890 (F. M. Webster). Accession No. 16178, same collection. (8 ♀ tagmounted; 14 ♀ alcohol, 1 vial).

12. 1 ♂, 6 ♀, plus 3 individuals of *viridescens*, reared from *Apanteles* cocoons on the larvæ of *Sphecodina abbotii* Swainson, Polo, Ill., July 20, 1893. Accession No. 19457. (1 ♂, 6 ♀ tagmounted, 6 host cocoons).

13. 9 ♂, 54 ♀, plus one specimen of *viridescens*, reared from larva of *Phlegethontius*, secondary, Champaign, Ill., August 27, 1895, (W. G. Johnson). Accession No. 21495, Illinois State Laboratory of Natural History. (63 ♂ ♀ tagmounted).

14. "*Pteromalus n. sp.*" Riley, in. litt., June 13, 1891. 1 ♂ reared in connection with *(Acrobasis) Mineola indigenella* Zeller, Urbana, Ill., March 25, 1889 (John Marten), relations unknown. Accession No. 14783, same collection. (1 ♂ tagmounted; xylol-balsam, ♂ antennæ, mandibles, 1 slide).[4]

15. 1 ♂, 11 ♀ specimens reared from the cocoons of *Apanteles* on the larva of *Phlegethontius sexta* (Johannsen), Urbana, Ill., Sept. 17, 1908 (G. E. Sanders). Accession No. 39857, Illinois State Laboratory of Natural History. (1 ♂, 11 ♀, on tags).

16. A pair of specimens reared from same host as in preceding, same place, Sept. 12, 1908 (G. E. Sanders). Accession No. 39931, same collection. (Tags ♂ ♀).

4) This is probably an undescribed species, distinguished from *viridescens* only by having the funicle joints of the antennæ twice longer than wide (joint 1), distinctly longer than with the type species, and perhaps in the different shape of the teeth of the mandibles.

The species under consideration was originally described by Benjamin Dann Walsh (1861) in the following manner:

"Family *Chalcididæ*. Subfamily *Peteromalides.*

It is with some hesitation that I refer the following species in this very extensive and difficult family, to *Glyphe,* Wilkinson. It is one of three remarkable congeneric species in my cabinet, which are all characterized by the last joints of the antennæ, when viewed from above, being elongate-acuminate, but when viewed in profile, being reduced to one-fourth the width of the penultimate joint, and attached on one side of it like a tarsal claw. In *Glyphe* the last joint is said simply to be elongate-acuminate. In other respects the characters tolerable well. In one of my three species, parasitic on *Microgaster xylina,* Say, the antennæ are notably moniliform. The other one of the three is the well known parasite of the Hessian fly, which, at the commencement of Say's entomological career, he arranged by mistake under the Proctotrupid genus *Ceraphron* (*C. destructor,* Say), which Westwood subsequently, misled by Say's figure, declared must be evidently one of the *Eulophides,* the fifth subfamily of the *Chalcididæ,* (Westwood's intr., II, page 160,) which Harris afterwards erroneously called a *Eurytoma,* the typical genus of the second subfamily of *Chalcididæ,* (Harris, Inj. Ins., p. 432.) ; but which I have no doubt from the structure of the prothorax, ought to be arranged somewhere among the *Pteromalides,* the third subfamily of *Chalcididæ.* Whether or not we choose to refer it to *Glyphe* is another matter. Perhaps a new genus will have to be founded for the reception of these three species.*

Glyphe viridascens. Fig. XI. New Species. Length of body .07 inch, or not quite 2 millimetres. General color, dark green, verging on black. Head finely and densely punctured; palpi whitish, eyes black; antennæ light brown, the basal joint received in a shallow, wide longitudinal

* The foot note referred to here is omitted as being but indirectly relavant.—A. A. G.

depression. Thorax finely and densely punctured; legs yellowish white; tips of tarsi dusky; wings hyaline; subcostal nervure brown and prolonged on the costa to the extreme tip of the wing. Abdomen black, glabrous, polished, flat above, convex beneath, so as in those individuals with acuminate anus—which I take to be females, but which Wilkinson takes to be males—to appear almost triangular when viewed in profile.

Bred five specimens from a mass of the army worm cocoons for some unknown *Ichneumon* I have not met with in Rock Island county. Four of the five have the antennæ still covered with the transparent pupal membrane which we often find on the antennæ of immature Cerambycids, but the structure of the apical joints of the antennæ is distinctly visible in these." (Walsh, 1861, p. 370).

The figure referred to in the original description is crude and misleading rather than helpful, as erroneous and poorly executed figures always are. Walsh gives nothing more in regard to the species excepting a brief paragraph on page 364 referring to the figure and a remark concerning the status of the species as a parasite of the "ichneumon," which Riley (1881) afterwards stated to be *Apanteles militaris* (Walsh). The spelling of the specific name is evidently due to an error, corrected later by Walsh (1865) himself and others and therefore unnecessarily so by de Dalla Torre (1898).

About four years later Asa Fitch (1865), treating of the parasites of the Northern Tobacco Worm *(Phlegethontius quinquemaculata* Haworth), gave a somewhat running and lengthy account of this hyperparasite and redescribed it as new under the name of *Pteromalus tabacum;* Fitch also gave a brief description of the male, described for the first time.

In order to bring all the literature of this genus together in this connection, as well as for a matter of interest I herewith quote Fitch's description given on pages 225-227:

"These destroyers of the insect which destroys the tobacco worm are very small four-winged flies of a shining dark-green color, with pale yellowish legs and white feet. They belong to the order of *Hymenoptera* and the family *Chalcididæ*, and are closely related to

the Hessian fly parasite, *Semiotellus destructor,* figured in my Seventh Report, plate 3, fig. 1, which figure will also serve to represent this insect in almost every particular. It pertains to the genus *Pteromalus,* a name derived from two Greek words, meaning bad wings, the wings in these insects being nearly destitute of ribs or veins. As they, by destroying the parasite of the tobacco-worm, cause that worm to be more numerous, and hereby more injurious to the tobacco, and as they will often occur lurking about this plant in search of the cocoons upon which to bestow their eggs, they may not inappropriately be named the Tobacco *Pteromalus.* All the flies which came from the cocoons were females, from which the following description is drawn:

* The Tobacco **Pteromalus** *(Pteromalus Tabacum),* is one-tenth of an inch long to the end of its body, and is of a dark or bottle-green color with a brassy reflection, and finely shagreened upon the head and thorax. The *head* is large and placed transversely, about three times as broad as it is long, convex in front and concave at its base, viewed in front it is nearly circular, with a large oval eye, slightly protruding on each side, of a dull red color fading to brown after death. On the crown three ocelli or eyelets appear as glassy dots placed at the corners of a triangle. The jaws are yellow, their ends brown, with four minute teeth, the palpi or feelers are dull white. The antennæ are inserted in the middle of the face and when turned backward reach about half the length of the thorax. They become a little thicker towards their tips, and are of a brown color, with the long basal joint dull pale yellow, and are clothed with a short incumbent beard. They are composed apparently of nine joints, the first joint being long and smooth, and forming an angle with the remaining joints. The second is the smallest of the series, being but little longer than thick and obconic in its form. The third joint is thrice as long and nearly thrice as thick as the preceding and has the shape of a pear, the contracted portion of its base being formed of two rings or small joints which are rarely perceptible even in the live specimen when highly magnified, except these organs

* Beginning page 226.

be put upon the stretch. The fourth and following joints are a third shorter than the foregoing and are nearly equal and square in their outline, each successive joint very slightly increasing in thickness and diminishing in length. The last joint is about thrice as long as the one preceding it, of an oval or subovate form, rounded at its base and bluntly jointed at its apex, and is probably composed as in the other species of this genus of three joints compactly united together. The *thorax* scarcely equals the head in width and is egg-shaped and thrice as long as wide. On each shoulder is a slightly impressed line extending obliquely backward and inward. The *abdomen* is a third shorter than the thorax, and in the live insect surpasses it in thickness, is egg-shaped and convex with its tips acute-pointed. When dried it scarcely equals the thorax in thickness and becomes strongly concave on the back and triangular when viewed on one side. It is smooth, polished and sparkling, of a green black color, the middle segments each with a broad purple black band visible in particular reflections of the light. Beneath it is black and at the tip shows some fine impressed longitudinal lines forming the edges of the groove in which the sting is enclosed. The *legs* are slender, pale wax yellow, with the feet and ends of the shanks dull white, the hips of the hind legs being stout and black, with their outer faces green blue and their tips pale yellow. The feet are five-jointed and dusky at their tips. The *wings* are transparent and reach slightly beyond the tip of the abdomen when at rest. The anterior ones are broad and evenly rounded at their ends, and have, near the outer margin, a thick brown rib or subcostal vein, extending more than a third of their lengths and then uniting with the margin and terminating some distance forward of the tip, after sending off a short straight stigmal branch which is thickened at its end, with apex notched. Towards the inner margin an exceedingly fine longitudinal vein* is perceptible, which, near its middle gives off a fine branch running almost to the inner hind end of the wing. The hind wings are much smaller and without veins, except a brown subcostal one which extends into the outer margin and abruptly ends a little beyond the middle.

* Beginning page 227.

> All of the examples of this species which I have obtained from the cocoons of the Tobacco-worm have been females. The last of August, 1862, I received from Dr. Allen, of Saratoga Springs, a larva of the *Sphinx kalmiæ*, to which thirty-six cocoon were adhering. * * * * * * * * * * * * * * * *
>
> Of the flies obtained from the Lilac-worm, four were males, whereby it appears that this sex differs from the females above described, in the following particulars; 1st, their color is lighter and more bright, being brilliant metallic green, when dried becoming blue green; 2nd, their antenæ are tarnished yellow, joints being cylindric and a third longer than thick, longer and not at all thickened toward the tips, their joints being cylindric and a third longer than thick, with the last joint egg-shaped, and but little longer than its predecessor; 3rd, the abdomen is flattened oval and rounding at its tip, with a large translucent pale yellow spot near the base; 4th, the legs are paler and pure yellow without any mixture of orange or tawny." (Fitch, 1865, pages 225-227).

Fitch gave a much better description of the species than did Walsh, but he was misled in regard to some of the structures; by comparing the two descriptions one could hardly say that they disagree in essentials; rather, the second supplements the first. Fitch reared the species from the cocoons of *Apanteles congregatus* (Walsh) when parasitic on *Phelegethontius* and also from some microgaster cocoons on the larva of *Sphinx kalmiæ* Smith and Abbot.

Some years later, Riley (1881)[5] mentioned the rearing of this hyperparasite by Walsh from *Apanteles militaris* (Walsh) and called attention to the fact that Walsh's *viridescens* and Fitch's *tabacum* were the same[6], referring to the species as *Glyphe viridescens* Walsh and also recording it as a parasite of *Apanteles congregatus* (Say) when parasitic on *Heliophila unipuncta* Haworth. During the same year Thomas (1881) listed the species among the parasites of *Heliophila unipuncta* Haworth as being a second-

5) And see Packard (1861).

6) But later (Riley, 1883) he referred it doubtfully to *Tridymus* Ratzeburg.

ary parasite on *Apanteles congregatus* (Say), and quoted the original description of Walsh, omitting the first and last paragraphs.

After Riley (1881), the species was listed separately under the names given it, placed in widely separated subfamilies and the error has been continued to the present day.

As I have examined undoubted specimens of both *Glyphe viridescens* Walsh and *Pteromalus tabacum* Fitch, finding them identical and with single tibial spurs on the caudal tibiæ, the species which we shall now call *Hypopteromalus viridescens* (Walsh) belongs to the *Pteromalidæ* and can have no relationship to *Glyphe* Walker (=*Gastrancistrus* Westwood) or *Tridymus* Ratzeburg, both genera of the *Miscognasteridæ*.

But very little has been recorded concerning its habits and host relations since the time of Fitch; it was bred from microgaster cocoons by Morgan in Louisiana, (Riley and Howard 1892). Garman (1897) first recorded it as a secondary parasite of *Phlegethontius sexta* (Johannsen), its host being *Apanteles congregatus* (Say); Lintner (1898) as a primary parasite of *Apanteles limenitidis* (Riley) on *Heliophila unipuncta* Haworth; Dimmock (1898) as a parasite of an *Apanteles* on *Smerinthus* and from *Ampelophaga;* and finally, Howard and Chittenden (1907) record it from *Microplitis catalpæ* (Riley) when parasitic on *Ceratomia catalpæ* Boisduval; and I have bred it at Baltimore, Md., in 1904, from what appeared to be the cocoons of *Apanteles smerinthi* Riley on a willow leaf, as mentioned above; and recently it was reared in large numbers from the cocoons of *Apanteles congregatus* (Say), parasitic on the tobacco worm (*Phlegethontius sexta* Johannsen), State Entomologist of Illinois; the hosts were obtained at Urbana, Ill., August 17 and 28, 1908, and the parasites and hyperparasites emerged during the following September:

From one of the host larvæ were taken 327 cocoons of the *Apanteles* from which afterward emerged 244 *Hypopteromalus viridescens,* 23 *Apanteles congregatus,* and 24 *Mesochorus.* From a second host larva were taken 101 cocoons from which emerged in due course 12 adult *Apanteles,* 68 *Mesochorus* and 2♂, 3♀ of *viridescens.* From a third lot of 111 cocoons removed from a single host larva, there were obtained *7 Apanteles, 73 Mesochorus* and but a single female of *viridescens* From a fourth lot of 248 cocoons emerged 123 *Apanteles* and 60 *viridescens.* And from a

fifth and last lot of 148 cocoons taken from a single host larva, there emerged 93 *Apanteles,* 15 *Mesochorus,* and 23 *viridescens.* Of the total number of 935 cocoons of *Apanteles congregatus* (Say), or of that number of larvæ successfully coming to full growth on five host larvæ, but about 258 or 27.5% survived to maturity. Other rearings of the species are as recorded in the foregoing.

Habits of the Species

The manner of emergence of this parasite from the cocoons of *Apanteles congregatus* (Say) is ably described by Fitch as follows:

"And after these flies have left their cocoons, it is readily told by the appearance of each cocoon whether it is a *Microgaster* or a *Pteromalus* fly which has come out from it. The *Microgaster*, by which all the cocoons are constructed, makes an opening for its escape in a more neat and artistic manner than does its destroyer. * * * * * * * * The enclosed fly then pressing its head against the lid raises it up and crawls forth from its prison. Thus the evacuated cocoon has its end smoothly cut off with the severed portion usually adhering to it. The *Pteromalus* fly, on the other hand, being a size smaller, is able to move about and can probably turn itself around inside the cocoon. And to make its escape, it gnaws a hole through the side near one end, of sufficient size for its body to pass through, this hole in different instances being round, oval, or irregular, and its edges ragged and uneven." (Page 228).

In regard to the habits of the adult, Fitch has the following to say:

"This insect, * * * * * * * * * * * * * *, appears tame and sedate, walking around slowly, and as if with deliberation as to what it is doing; and if any annoyance approaches it, to escape therefrom, it gives a slight skip, throwing itself about an inch, and repeating this leap again and again if pursued, it being not at all inclined to take wing." (Page 227).

Further than what is known concerning its host relation, and the few observations quoted from concerning its habits, but very little else of importance is known concerning the biology of the species.

It hibernates in the cocoons of its hosts as indicated by the records of rearings given in the foregoing and what is stated by

Fitch (1865, p. 225), but in what stage is unknown. The latter author's supposition that a single female deposited a hundred or more eggs is not founded on a good premise, for it is clear that more than one female may have been concerned. The parasite is solitary, a single one emerging from the cocoon of its host and there is good evidence to show that it deposits its eggs into or on the fullgrown larva or recent pupa of its host within its cocoon.

Literature Referring to Hypopteromalus.

1861. PACKARD, ALPHEUS SPRING. Sixth Ann. Rep. Secretary Maine Board of Agric., 1861, Augusta, p. 139.

Glyphe viridescens recorded from ***Apanteles militaris*** (Walsh). Based on Walsh (1861).

1861. WALSH, BENJAMIN DANN. Insects Injurious to Vegetation in Illinois. Transactions Illinois State Agric. Soc., with etc., Springfield, Ill., IV, (1859-1860), pp. 364; appendix 370; pl., fig. 11. Separate (see Howard, 1885).

Original Description, bred from some primary ichneumonoid parasite of *Leucania unipuncta* Haworth. (Probably ***Apanteles militaris*** (Walsh).

1865. FITCH, ASA. Insects Infesting Gardens. Sixth, seventh, eighth and ninth reports on noxious, beneficial and other insects, State of New York. Made to the etc., Albany, ninth Rep., pp. 224-228. Separate (see Howard, 1885). ?Transactions New York State Agric. Society, XXIII, 1863, p.

Redescription as new under the name of ***Pteromalus tabacum;*** its hosts and habits.

1865. WALSH, BENJAMIN DANN. Insects Injurious to Vegetation in Illinois. Trans. Ill. State Agric. Society, with reports etc., Springfield, V. (1861-1864), p. 483, fig. 11. (*Glyphe viridescens*, n. sp. On some undetermined parasite of the army worm).

Premium essay; copied from Walsh (1861); figures and mentions incidentally.

1870. RILEY, CHARLES VALENTINE. The Army-worm. Second annual report on the noxious, beneficial and other insects of the state of Missouri, made to etc., Jefferson City, p. 53, fig. 24.

Glyphe viridascens mentioned as a parasite of ***Apanteles militaris*** when parasitic upon ***Heliophila unipuncta*** Haworth; the figure is the original one of Walsh (1861).

1876. RILEY, CHARLES VALENTINE. Ninth report on the noxious, beneficial and other insects of the state of Missouri made to etc., Jefferson City, p. 53.

The same as Riley (1870), without the figure. *G. viridascens.*

1877. PACKARD, ALPHEUS SPRING. Ninth annual report U. S. geological and survey Territories, embracing etc., for 1875, Washington, D. C., p. 706.

Mentioned as parasitic on *Apanteles militaris* (Walsh).

1881. RILEY, CHARLES VALENTINE. Notes on North American Microgasters, with descriptions of new species. Transactions Academy Sciences St. Louis, (Missouri), IV, (1878-1886), p. 302. Separate p. 7.

Glyphe viridascens Walsh equals *Pteromalus tabacum* Fitch; hosts.

1881. THOMAS, CYRUS. Tenth report, State Ent. on noxious, beneficial insects, state of Illinois, Springfield, p. 39.

1883. RILEY, CHARLES VALENTINE. The army worm (Leucania unipuncta Haw.) Third report, U. S. Ent. Commission, relating to etc., U. S. Dept. Agric., Washington, D. C., p. 127.

"From the cocoons of the Military *Microgaster* there often issue individuals of a minute secondary parasite—a chalcid, called by Walsh *Glyphe viridascens*, but which probably belongs to the genus *Tridymus.*"

"* * * * This species is also parasitized by the *Glyphe viridascens* mentioned above. The latter, by the way, is identical with the *Pteromalus tabacum* of Fitch, who bred it from *Apanteles congregatus*, when parasitic upon the tobacco worm (*Macrosila quinquemaculata*)."

1885. HOWARD, LELAND OSSIAN. Bull. No. 5, Bureau Ent., U. S. Dept. Agric., Washington, D. C., pp. 44, 45.

The species listed separately under the names of Walsh and Fitch.

1887. CRESSON, EZRA TOWNSEND. Synopsis of the Hymenoptera of America, North of Mexico. Transactions American Ent. Soc., Philadelphia, supplementary volume, 1887, pp. 242, 243.

The same as Howard (1885).

1892. RILEY, CHARLES VALENTINE AND HOWARD, LELAND OSSIAN. Insect Life, Division Ent., U. S. Dept. Agric., Washington, D. C., V, p. 138.

Answer to correspondent. *Glyphe viridescens* (Walsh) identified as a parasite of *Apanteles* cocoons.

1897. GARMAN, HARRISON. Bull. No. 66, Kentucky Agric. Exp. Station, Lexington, p. 28, footnote.

"Hypoptermalus tabacum" and *Mesochorus luteipes* mentioned as being parasitic on *Apanteles congregatus* (Say), both secondary on *Phlegethontius sexta* and *P. quinquemaculata.*

1897. LINTNER, JOSEPH ALBERT. Twelfth report on injurious and other insects of State of New York for year 1896. (From the Fiftieth report, New York State Museum), Albany, p. 210.

"Glyphe viridascens" **parasitizes *Apanteles militaris*** **(Walsh) and *A. limenitidis*** **(Riley) on *Heliophila unipuncta*** **Haworth.**

1898. DE DALLA TORRE, CARL G. Catalogus hymenopterorum hujusque descriptorum systematicus at synonymicus, Lipsiæ, V, pp. 150, 205.

Pteromalus tabacum **Fitch.** ***Gastrancistrus viridescens*** **(Walsh); specific name unnecessarily amended.**

1898. DIMMOCK, GEORGE. Proceedings Ent. Soc., Washington, IV, pp. 149-150.

1900. ASHMEAD, WILLIAM HARRIS. In John Bernhard Smith, Insects of New Jersey. A list, etc. Supplement, Twenty-seventh annual report State Board Agric. 1899, Trenton, p. 559.

1904. ASHMEAD, WILLIAM HARRIS. Classification of the chalcid flies of the superfamily Chalcidoidea, with etc. Memoirs Carnegie Museum, Pittsburgh, I, No. 4 (Publications of the Carnegie Museum, Serial No. 21), pp. 320, 378.

1906. NASON, WILLIAM A. The parasitic Hymenoptera of Algonquin, Illinois, Ent. News, Philadelphia, XVII, p. 152.

1907. HOWARD, LELAND OSSIAN and CHITTENDEN, FRANK HURLBURT. The Catalpa Sphinx (*Ceratomia catalpæ* Bdv.) Circular No. 96, Bureau Ent., U. S. Dept. Agric., Washington, D. C., p. 5.

"Hypopteromalus tabacum **Fitch" reared in large numbers from a single lot of larvæ of *Ceratomia catalpæ*** **Boisduval, together with *Horismenus microgastri*** **(Ashmead), the former Chalcidid, at least, attacking *Apanteles Micropitis catalpæ*** **(Riley), the primary parasite of the sphingid.**

1909. CRAWFORD, J. C. Proceedings Ent. Soc., Washington, XI, p. 52.

1909. SCHMIEDEKNECHT, OTTO. Genera Insectorum (diriges par P. Wytsman), Bruxelles, 97me fascicule, Family *Chalcididæ*, p. 355.

1910. CRAWFORD, J. C. Bull. No. 19, technical series, Part II, Bureau Entomology, U. S. Dept. Agric., Washington, D. C., pp. 21-22.

On account of the fact that this hyperparasite attacks insects of economic importance, it has been mentioned by the earlier writers such as Walsh, Riley and Fitch in various nonscientific agricultural journals, but as nothing new is contained in such places, it is not considered our place here to take cognizance of them.

Urbana, Ill., August, 1911,
A. A. Girault, Brisbane, Australia.